DataDirect Networks, Inc

StorageScaler 6000 Drive Enclosure User Guide

96-00189-001 Rev B

March, 2010

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Preface

What is in this guide

This user guide gives you step-by-step instructions on how to install, configure, and connect the StorageScaler 6000 storage subsystem to your host computer system, as well as to use and maintain the system.

Who should use this guide

This user guide assumes that you have a working knowledge of the Serial Attached SCSI (SAS) protocol environments into which you are installing the StorageScaler 6000 system.

International Standards

The StorageScaler 6000 storage system complies with the requirements of the following agencies and standards:

- CE
- UL

Potential for Radio Frequency Interference

USA Federal Communications Commission (FCC)

Note This equipment has been tested and found to comply with the limits for a class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Properly shielded and grounded cables and connectors must be used in order to meet FCC emission limits. The supplier is not responsible for any radio or television interference caused by using other than recommended cables and connectors or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

European Regulations

This equipment complies with European Regulations EN 55022 Class A: Limits and Methods of Measurement of Radio Disturbance Characteristics of Information Technology Equipment and EN50082-1: Generic Immunity.

Qualified Personnel

Qualified personnel are defined as follows:

- ***Service Person:*** A person having appropriate technical training and experience necessary to be aware of hazards to which that person may be exposed in performing a task and of measures to minimize the risks to that person or other persons.
- ***User/Operator***: Any person other than a *Service Person.*

Safe Handling

- Remove drives to minimize weight.
- Do not try to lift the enclosure by yourself.
- Do not lift the StorageScaler 6000 by the handles on the power cooling module (PCM); they are not designed to support the weight of the populated enclosure.

Weight Handling Label: Lifting and Tipping

Safety

Important **If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.**

Warning **The StorageScaler 6000 enclosure *MUST* be grounded before applying power.**

Unplug the unit if you think that it has become damaged in any way and before you move it.

Caution *Plug-in modules are part of the fire enclosure and must only be removed when a replacement can be immediately added. The system must not be run without all units in place. Operate the system with the enclosure top cover closed.*

- In order to comply with applicable safety, emission and thermal requirements no covers should be removed.

- The StorageScaler 6000 unit must only be operated from a power supply input voltage range of 200 V AC to 240 V AC.
- The plug on the power supply cord is used as the main disconnect device. Ensure that the socket outlets are located near the equipment and are easily accessible.

Warning **To ensure protection against electric shock caused by HIGH LEAKAGE CURRENT (TOUCH CURRENT), the StorageScaler 6000 must be connected to at least two separate and independent sources. This is to ensure a reliable earth connection.**

Warning **The equipment is intended to operate with two (2) working PCMs. Before removing a PCM, please disconnect the power from the power supply, by either the switch (where present) or by physically removing the power source, prior to removing the PCM from the enclosure/shelf.**

- Do not remove a faulty PCM unless you have a replacement unit of the correct type ready for insertion.
- A safe electrical earth connection must be provided to the power cord.
- Provide a suitable power source with electrical overload protection to meet the requirements laid down in the technical specification.

Warning **Do not remove covers from the PCM. Danger of electric shock inside. Return the PCM to your supplier for repair.**

PCM Safety Label: Electric Shock Hazard Inside

Warning **Operation of the Enclosure with *ANY* modules missing will disrupt the airflow and the drives will not receive sufficient cooling. It is *ESSENTIAL* that all apertures are filled before operating the unit.**

Recycling of Waste Electrical and Electronic Equipment (WEEE)

At the end of the product's life, all scrap/ waste electrical and electronic equipment should be recycled in accordance with National regulations applicable to the handling of hazardous/ toxic electrical and electronic waste materials.

Please contact your supplier for a copy of the Recycling Procedures applicable to your product.

Important **Observe all applicable safety precautions, e.g. weight restrictions, handling batteries and lasers etc, detailed in the preceding paragraphs when dismantling and disposing of this equipment**

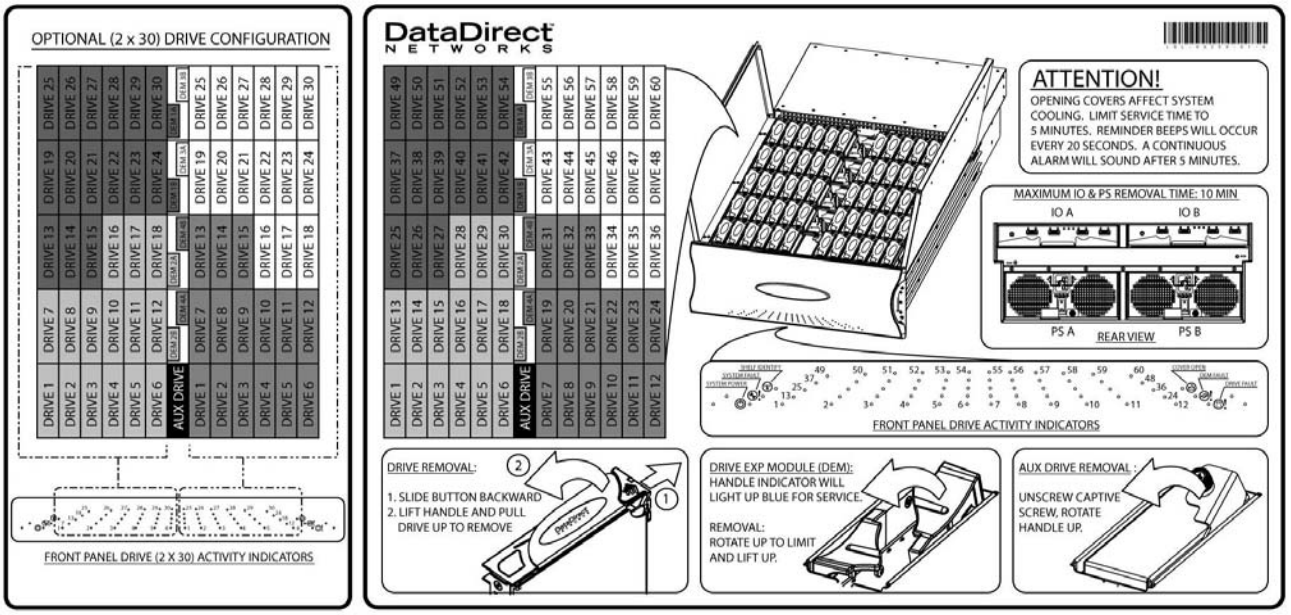
Rack System Precautions

The following safety requirements must be considered when the unit is mounted in a rack.

- The rack construction must be capable of supporting the total weight of the installed enclosure(s) and the design should incorporate stabilizing features suitable to prevent the rack from tipping or being pushed over during installation or in normal use.
- When loading a rack with the units, fill the rack from the bottom up and empty from the top down.
- Always remove all modules and drives, to minimize weight, before loading the chassis into a rack.

Warning **It is recommended that you do not slide more than one enclosure out of the rack at a time, to avoid danger of the rack tipping over.**

- When mounting in a rack, ensure that the enclosure is pushed fully back into the rack.
- The system must be operated with low pressure rear exhaust installation. (The back pressure created by rack doors and obstacles should not exceed 5 pascals [0.5mm water gauge].)
- The rack design should take into consideration the maximum operating ambient temperature for the unit is 35°C.
- The rack should have a safe electrical distribution system. It must provide over current protection for the unit and must not be overloaded by the total number of units installed in the rack. Consideration of the units nameplate rating should be used when addressing these concerns.
- The electrical distribution system must provide a reliable earth ground for each unit and the rack.
- Each power supply in each unit has an earth leakage current of 1.5mA. The design of the electrical distribution system must take into consideration the total earth leakage current from all the power supplies in all the units. The rack will require labelling with “*HIGH LEAKAGE CURRENT. Earth connection essential before connecting supply*.”
- The rack when configured with the units must meet the safety requirements of UL 60950 and IEC 60950.


OPTIONAL (2 x 30) DRIVE CONFIGURATION
FRONT PANEL DRIVE (2 X 30) ACTIVITY INDICATORS
DataDirect NETWORKS
ATTENTION!
OPENING COVERS AFFECT SYSTEM COOLING. LIMIT SERVICE TIME TO 5 MINUTES. REMINDER BEEPS WILL OCCUR EVERY 20 SECONDS. A CONTINUOUS ALARM WILL SOUND AFTER 5 MINUTES.
MAXIMUM IO & PS REMOVAL TIME: 10 MIN
IO A
IO B
PS A
REAR VIEW
PS B
FRONT PANEL DRIVE ACTIVITY INDICATORS
DRIVE REMOVAL:
1. SLIDE BUTTON BACKWARD
2. LIFT HANDLE AND PULL DRIVE UP TO REMOVE
DRIVE EXP MODULE (DEM):
HANDLE INDICATOR WILL LIGHT UP BLUE FOR SERVICE.
REMOVAL:
ROTATE UP TO LIMIT AND LIFT UP.
AUX DRIVE REMOVAL :
UNSCREW CAPTIVE SCREW, ROTATE HANDLE UP.

Cover Label

ESD Precautions

Caution *It is recommended that you fit and check a suitable anti-static wrist or ankle strap and observe all conventional ESD precautions when handling StorageScaler 6000 plug-in modules and components. Avoid contact with backplane components and module connectors, etc.*

Data Security

- Power down your host computer and all attached peripheral devices before beginning installation.
- Each enclosure contains up to 60 removable disk drive modules. Disk units are fragile. Handle them with care, and keep them away from strong magnetic fields.
- *All* the supplied plug-in modules and blanking plates must be in place for the air to flow correctly through the enclosure and also to complete the internal circuitry.
- If the subsystem is used with modules or blanking plates missing for more than a few minutes, the enclosure can overheat, causing power failure and data loss. Such use may also invalidate the warranty.
- If you remove a drive module, replace it immediately. If it is faulty, replace it with a drive module of the same type and capacity

- Ensure that all disk drives are removed from the enclosure before attempting to move the rack installation.
- Do not abandon your backup routines. No system is completely foolproof.

Chapter 1

Introduction

1.1 The StorageScaler 6000 System

The StorageScaler 6000 storage system is an ultra dense 4U 60 disk drive enclosure based on 3.5 inch SAS or SATA Hard Disk Drives (HDDs). Figure 1–1 and Figure 1–2 show front and rear views of a StorageScaler 6000 enclosure respectively. Module and major components and their locations are shown in Figure 1–3.

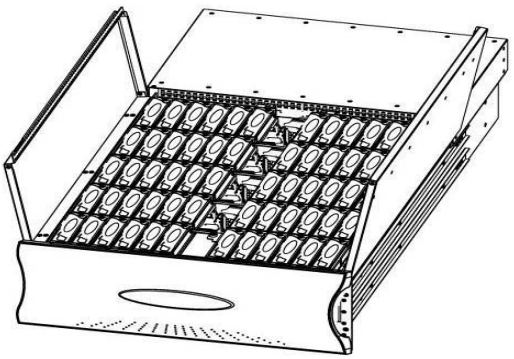


Figure 1–1 The StorageScaler 6000 System - front open view

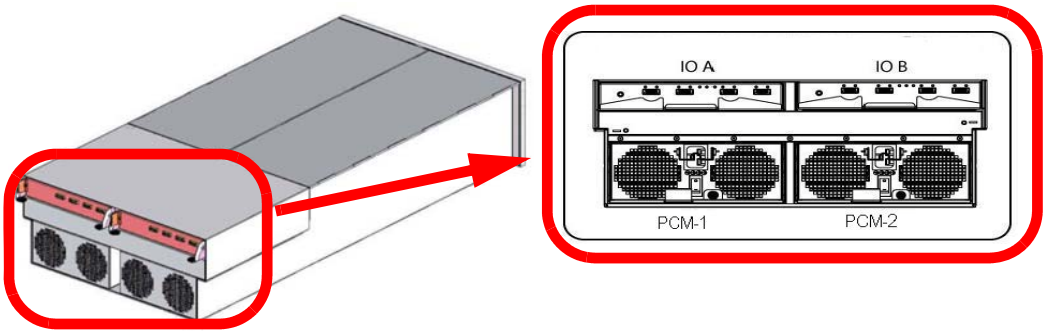


Figure 1–2 The StorageScaler 6000 System - rear isometric and rear views

1.2 Enclosure Core Product

The StorageScaler 6000 design concept is based on a subsystem together with a set of plug-in modules and *(as supplied)* comprises:

- **Enclosure Chassis** with integral Front Panel Drive Status Indicator **(**Figure 1–10).
- Two (2) 1865W **Power Cooling (PCM)** plug-in modules (Figure 1–4).
- Two (2) plug-in **Input/Output (I/O)** modules (Figure 1–6).
- A midplane separates the front and back of the chassis and provides the interconnect system between the PCMs, I/O modules, and the baseboard.
- Up to 60 top loadable HDDs in a 5x12 matrix.
- Eight (8) SAS DEMs.

1.2.1 Enclosure Chassis

The chassis assembly contains 60 drive bays at the front, each of which accommodates a plug-in drive carrier module capable of holding a 3.5 inch SAS or SATA Hard Disk Drive (HDD). The 60 drive bays are arranged in five rows of twelve drives (5x12). At the rear, the chassis assembly contains two (2) PCMs and two (2) I/O modules (Figure 1–3). The chassis is fitted with 19-inch rack mounting features which enables it to be fitted to 19-inch racks and uses four (4) EIA units of rack space.

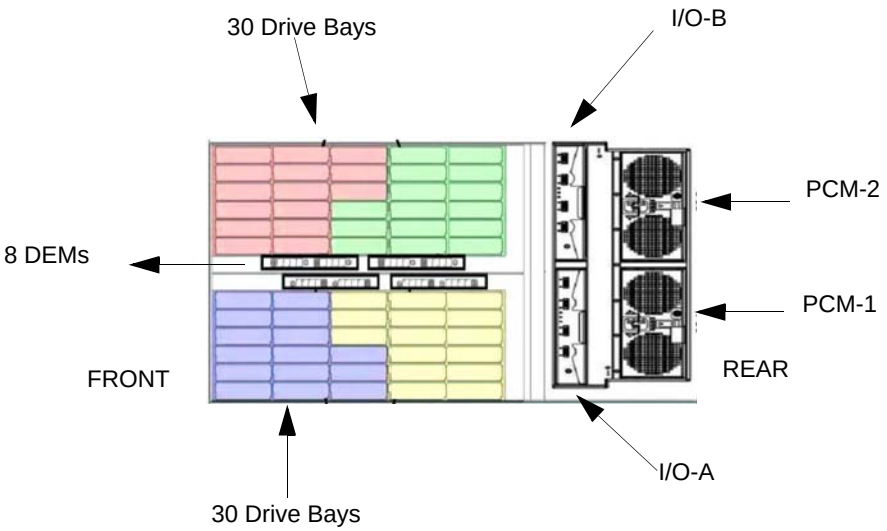


Figure 1–3 StorageScaler 6000 Module Locations (Top View)

1.3 The Plug-in Modules

The StorageScaler 6000 Enclosure requires the following modules for normal operation:

- Power Cooling Module (PCM)
- Input/Output Module (I/O)
- Drive Carrier Module
- DEM

1.3.1 Power Cooling Module (PCM)

Two (2) auto ranging AC 1865W Power Cooling modules (Figure 1–4) are supplied already mounted in the rear of the enclosure as part of the subsystem core product.

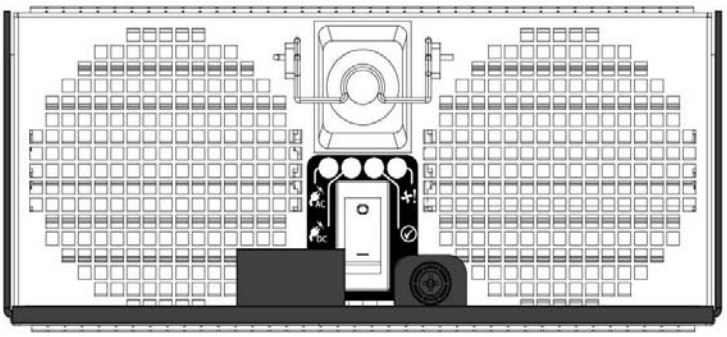


Figure 1–4 Power Cooling Module (1)

The StorageScaler 6000 must always be operated with two (2) Power Cooling Modules fitted (2 PCMs). Module replacement should only take a few minutes to perform but must be completed within 10 minutes from removal of the failed module. Four (4) LEDs mounted on the PCM (Figure 1–5 and Table 1–1) indicate the status of the PCM and the fans. PCM voltage operating ranges are nominally 200V to 240V AC.

Figure 1–5 PCM LEDs View: Normal/Faults

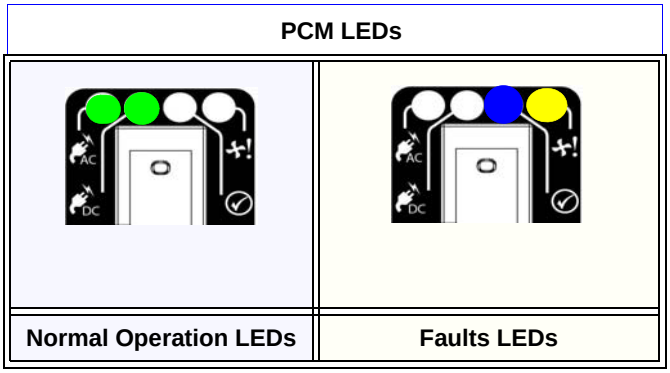


Table 1–1 PCM LEDs

ICON LED	Description	COLOR	Normal Behavior
	PCM AC ok	GREEN	**ON**-AC input to PCM within tolerances. **OFF**-failed PCM
	PCM DC ok	GREEN	**ON**-DC output of PCM within tolerances. **OFF**-failed PCM
	PCM Fault	AMBER	**ON**-PCM fault detected **OFF**-no detected PCM faults.
	PCM ID	BLUE	**ON**-receiving SES Identify command **OFF**-NOT receiving SES Identify command

1.3.2 Input/Output (I/O) Module

The StorageScaler 6000 storage subsystem includes an enclosure with rear facing bays which house two (2) I/O modules (Figure 1–6). Processors housed on the I/O modules provide enclosure management and interface to devices on the Backplane, PCM, and Display Panel in order to monitor internal functions. The plug-in I/O modules have been designed for integration into a StorageScaler 6000 storage subsystem, providing external SAS cable interfacing with up to 60 SAS or SATA disk drives.

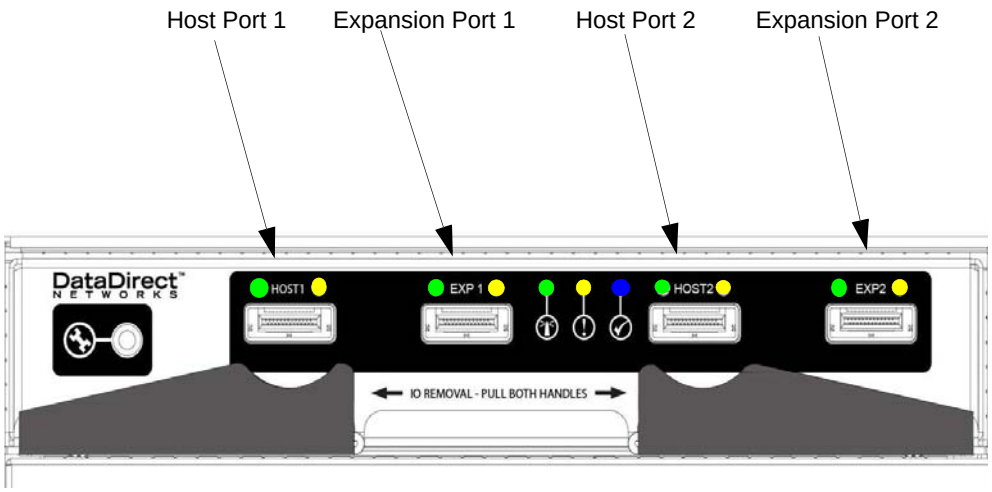


Figure 1–6 I/O Module

Table 1–2 defines the LED indicators incorporated on the I/O module.

Table 1–2 I/O Module LEDs

LED	Description	Color	Normal Behavior
Host Port 1 Expansion Port 1 Host Port 2 Expansion Port 2	SAS Link	Green	**ON**-a valid SAS link established on at least 1 of the 4 SAS links of the 4-wide SAS port **OFF**-no SAS links
Host Port 1 Expansion Port 1 Host Port 2 Expansion Port 2	SAS Link Fault	Amber	**ON**-a detectable fault on at least 1 of the 4 SAS links of the 4-wide SAS port **OFF**-no detectable faults
	I/O Module OK	Green	**ON**-properly booted and functioning correctly **OFF**-I/O Module internal fault
	I/O Module Fault	Amber	**ON**-I/O module fault detected **OFF**-no detected I/O module faults
	I/O Module Identify	Blue	**ON**-receiving SES Identify command **OFF**-NOT receiving SES Identify command

1.3.3 Drive Carrier Module and Status Indicator

The Drive Carrier Module comprises a hard disk mounted in a carrier (Figure 1–7). Each drive bay can house a single Low Profile 1.0 inch high, 3.5 inch form factor disk drive in its carrier. A fully loaded enclosure contains 60 drive carrier modules.

The handle provides the following functions:

- Camming of carrier into and out of drive bays.
- Positive 'spring loading' of the drive/baseplane connector.
- The handle assembly also incorporates a Drive Status LED (Figure 1–7).

Note The enclosure system design allows for drive bays to be left empty without the need for fitting dummy drive carriers.

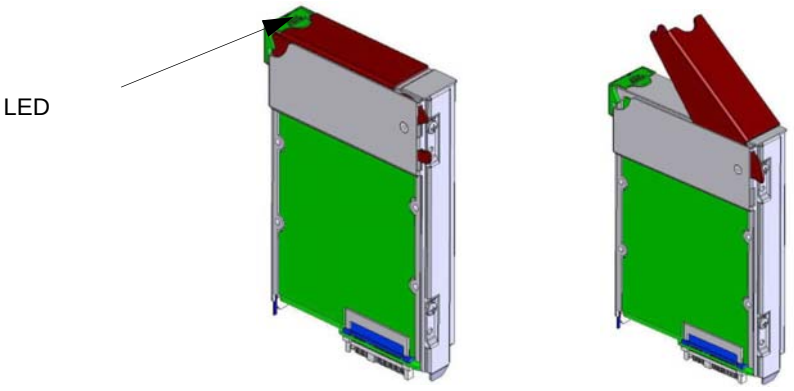


Figure 1–7 Drive Carrier Module: Closed and Opened

1.3.3.1 SATA Interposer Card

The StorageScaler 6000 enclosure supports a SATA interposer card which allows simultaneous access to the SATA HDD from both IO modules installed in the enclosure as well as the power cycling of a single HDD through SES commands.

Note A SATA interposer card is required to run SATA HDDs.

1.3.4 DEM Card

The StorageScaler 6000 enclosure contains eight (8) top-loadable, hot-swappable DEMs. The **DEM**s (Figure 1–8) provide the SAS connectivity between the I/O module and the HDDs located within the enclosure.

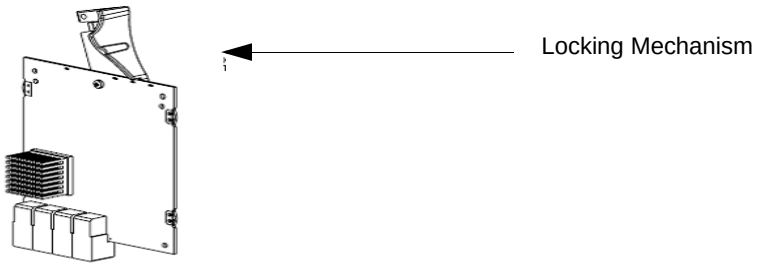


Figure 1–8 DEM

Note The DEM is a serviceable PCB which may be replaced by trained personnel.

Each DEM connects to a single port of the HDD based on the location within the enclosure within which it is installed (Figure 1–9). Each provides power control signals to each drive slot. It controls HDD identify/service LEDs and monitors the status from partner DEM. Each pair of DEMs supports 15 drives; there are 8 DEMs in a fully configured system.

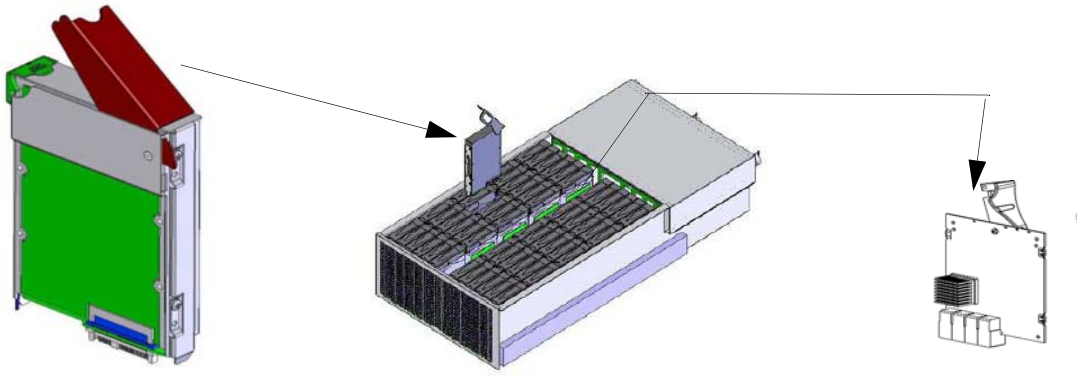


Figure 1–9 Drive Carrier and DEM Locations

Note In some components, the failure LED is internal to the enclosure and visible only when the cover is open. The Internal LED indicators are explained in Table 1–3.

Table 1–3 INTERNAL LED Indicators

Description	Location	Color	Normal Behavior
DEM DC	DEM internal to enclosure	GREEN	**ON**-1.2VDC regulator circuit correctly functioning **OFF**- faulty 1.2VDC regulator circuit
DEM ID	DEM internal to enclosure	BLUE	**ON**-receiving SES Identify command **OFF**-NOT receiving SES Identify command
HDD ID	HDD internal to enclosure	BLUE	**ON**-receiving SES Identify command **OFF**-NOT receiving SES Identify command

1.4 Front Panel Indicators

Note The Front Panel is an integral part of the enclosure chassis assembly and is not field replaceable.

The Front Panel Indicators show the aggregated status of all the modules and drive activity. This panel and its associated LEDs are shown in Figure 1–10. The Front Panel LEDs are defined in Table 1–4.

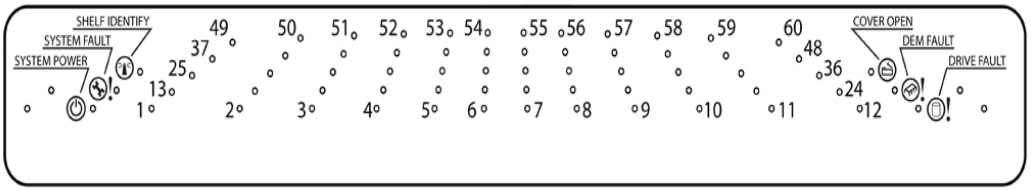

SHELF IDENTIFY
SYSTEM FAULT
SYSTEM POWER
COVER OPEN
DEM FAULT
DRIVE FAULT
1 2 3 4 5 6 7 8 9 10 11 12
13 24 25 36 37 48 49 50 51 52 53 54 55 56 57 58 59 60

Figure 1–10 Front Panel Indicators

Table 1–4 Display Panel LEDs

ICON	LABEL	COLOR	Definition	Normal Behavior
	Shelf Identify (Note 1)	AMBER	Enclosure Identify	**ON**-SES is sending an Identify command. **OFF**-SES is NOT sending an Identify command
	System Fault	AMBER	Enclosure Fault	**ON**-one or more components within enclosure have failed. A service action is required. Exact failed component has its own amber fault LED lit. **OFF**-no detectable faults
	System Power	GREEN	Enclosure Powered ON	**ON** - DC power is present **OFF** - DC power is NOT present LED does NOT flash under normal operating conditions.
	Cover Open	AMBER	Enclosure cover is open	**OFF**-both cover pieces securely closed and latched in place. **ON**-either of the cover pieces is NOT securely closed and latched in place
Note: The baseplane incorporates an Audible Alarm. This alarm is used to indicate a “cover open” condition. To silence alarm, close the cover.				
	DEM Fault (Note 2)	AMBER	DEM fault	**OFF**-all DEMs operating correctly. **ON**-at least one DEM has failed; service action required
	Drive Fault (Note 3)	AMBER	Drive fault	**ON**-one or more HDDs are faulted. SES must determine exact HDD. **OFF**-no detectable drive faults
Individually numbered	**HDDs**	GREEN	HDD activity	**ON**-indicates HDD activity **OFF**-no HDD activity

Note 1: not currently implemented

Note 2: not currently implemented

Note 3: not currently implemented

1.5 Environment

The enclosure and all of its sub-components are compliant to the European Union RoHS (Restriction of Hazardous Substances) Directive (Directive 2002/95/EC) with no exceptions or exemptions.

1.6 StorageScaler 6000 Technical Specification

1.6.1 Dimensions

Enclosure	**inches**	**millimeters**
Height	6.97	177
Width front	16.56	420.6
Width rear	17.56	446
Depth front surface of bezel to end of cable management arms	42	1067
LENGTH rack mounting surface to rear connectors surface	36	914

1.6.2 Weight

Item	Quantity per System	LBS (kg)	Extended Weight
Chassis Includes Base PCB & Midplane	1	83	83
PCM	2	12	24
I/O Module Drives	2	4	8
	60	2	120
Miscellaneous	1	5	5
Total Weight			240

1.6.3 AC INPUT PCM

Input Parameter	Value
Input Voltage	190 - 264 VAC
Input Frequency	47 - 63 Hz and 400 hz
Maximum Input Current	13.1A RMS @ 190 VAC
Peak Inrush Current	50A @ 230VAC, 25^0C, 5 msec max
Minimum Efficiency measured at 30% and 50% load and nominal line (208 VAC)	90%
Maximum Average Output Power	1750 W
Maximum Peak Output Power, 1 second	1922W

1.6.4 DC INPUT PCM

Input Parameter	Value
Input Voltage	36 - 72 VAC
Maximum Input Current	TBD
Peak Inrush Current	TBD
Minimum Efficiency measured at 30% and 50% load and nominal line (48 DVC)	90%
Maximum Average Output Power	1750 W
Maximum Peak Output Power, 1 second	1922W

1.6.5 DC OUTPUT PCM

Output Parameter	3.3 VDC Output	5 VDC Output	12 VDC Output
Normal Voltage	3.3 VDC	5.10 VDC	12.10 VDC
Full Load	5.0A	55.0A	120.0A
Peak Load for 1 Second	5.0A	65.0A	130.0A
Minimum Load (A)	0.0A	0.0A	0.0A

1.6.6 PCM Safety and EMC Compliance

Safety Compliance
UL 60950
IEC 60950
EN 60950

EMC Compliance
CFR47 Part 15B Class A
EN55022
EN55024

1.6.7 Power Cord

(minimum requirements)

Cord Type	SV or SVT, 18 AWG minimum, 3 conductor
Plug	250V, 10A
Socket	IEC 320 C-14, 250V, 15A

Note Power cord is not included in the standard StorageScaler 6000 enclosure package.

Chapter 2

Getting Started

2.1 Planning Your Installation

Before you begin installation you should become familiar with the configuration requirements of your StorageScaler 6000 system and the correct positions of each of the optional plug-in modules (Table 2–1).

.

Table 2–1 StorageScaler 6000 Configuration

Module	Location
Drive Bays	You can install from 1 - 60 drives in the enclosure. In 1x mode, (connected to 10 enclosures), you can install any number of drives in the enclosure, but every enclosure should have the same number of drives. In 2x mode, (connected to 5 enclosures), you must install drives in multiples of two (2). In 4x mode, (connected to 3 enclosures), you must intall drives in multiples of four (4).
Power Cooling Modules (PCM)	Two (2) PCMs must be fitted. Full power and cooling redundancy is provided while a faulty module is replaced. Install the PCMs in lower rear bays A and B. **Note:** Rear bays are numbered from A and B starting from the left when viewed from the back.
I/O Module	One or two I/O modules should be Installed in the upper rear bays A & B. **Note:** If only one module is installed, it should be fitted in Module Location A and a blank plate must be fitted over the unused bay.

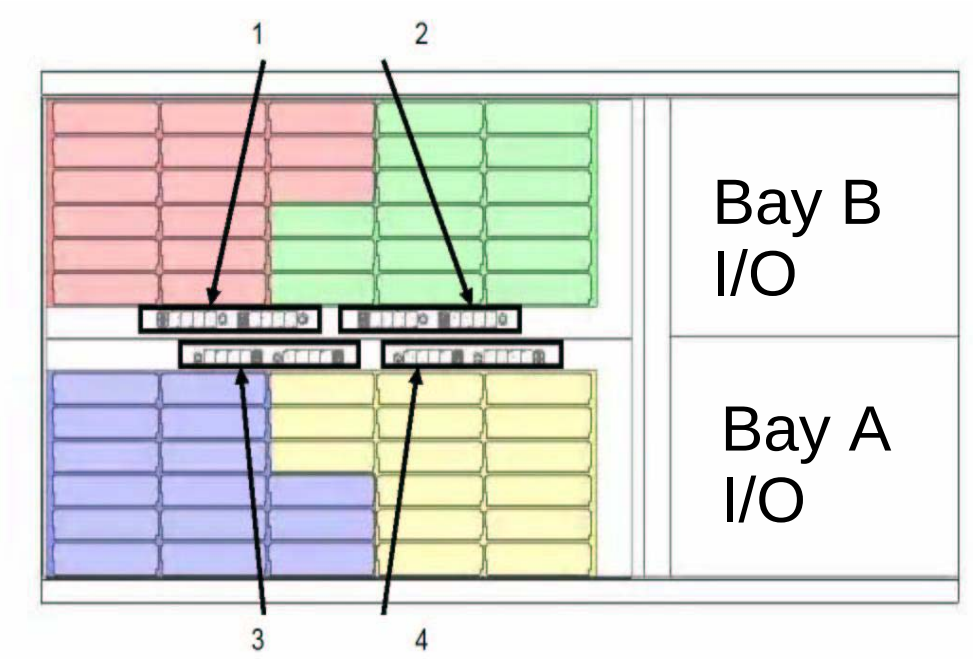


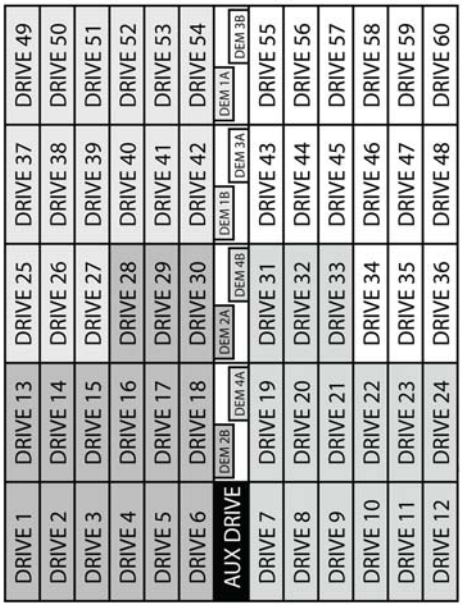
Figure 2–1 DEM Pair Locations

2.1.1 Enclosure Bay Numbering Convention

Warning **Operation of the Enclosure with *ANY* of the plug-in modules missing from the rear of the enclosure will disrupt the airflow and the drives will not receive sufficient cooling. It is *ESSENTIAL* that all (rear) apertures are filled before operating the unit.**

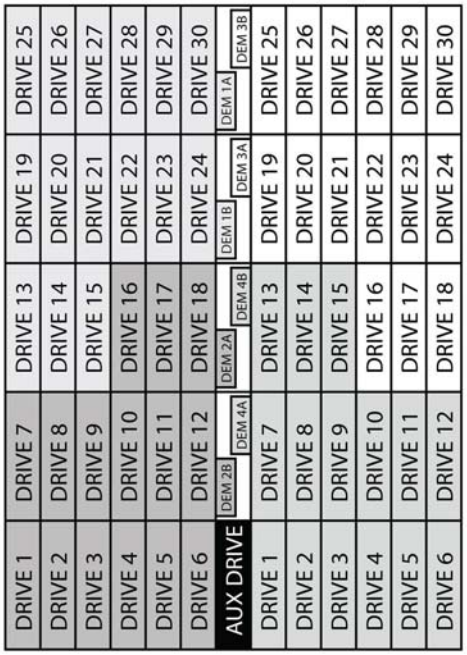
The StorageScaler 6000 subsystem is housed in a 60-drive bay enclosure, arranged in four (4) groups. Each group comprises two banks of 15 bays, that is, (as viewed from the front): 12 bays across the enclosure by 5 bays deep. There are two numbering schemes: 1x60 and 2x30. The drive bays are numbered in accordance with the tables shown in Figure 2–2 and Figure 2–3, when viewed from above.

Note Drive 61 is optional drive.



DRIVE 1	DRIVE 13	DRIVE 25	DRIVE 37	DRIVE 49
DRIVE 2	DRIVE 14	DRIVE 26	DRIVE 38	DRIVE 50
DRIVE 3	DRIVE 15	DRIVE 27	DRIVE 39	DRIVE 51
DRIVE 4	DRIVE 16	DRIVE 28	DRIVE 40	DRIVE 52
DRIVE 5	DRIVE 17	DRIVE 29	DRIVE 41	DRIVE 53
DRIVE 6	DRIVE 18	DRIVE 30	DRIVE 42	DRIVE 54
AUX DRIVE (DEM 2B, DEM 4A, DEM 2A, DEM 4B, DEM 1B, DEM 3A, DEM 1A, DEM 3B)				
DRIVE 7	DRIVE 19	DRIVE 31	DRIVE 43	DRIVE 55
DRIVE 8	DRIVE 20	DRIVE 32	DRIVE 44	DRIVE 56
DRIVE 9	DRIVE 21	DRIVE 33	DRIVE 45	DRIVE 57
DRIVE 10	DRIVE 22	DRIVE 34	DRIVE 46	DRIVE 58
DRIVE 11	DRIVE 23	DRIVE 35	DRIVE 47	DRIVE 59
DRIVE 12	DRIVE 24	DRIVE 36	DRIVE 48	DRIVE 60

Figure 2–2 1X60 Drive Numbering Table.



DRIVE 1	DRIVE 7	DRIVE 13	DRIVE 19	DRIVE 25
DRIVE 2	DRIVE 8	DRIVE 14	DRIVE 20	DRIVE 26
DRIVE 3	DRIVE 9	DRIVE 15	DRIVE 21	DRIVE 27
DRIVE 4	DRIVE 10	DRIVE 16	DRIVE 22	DRIVE 28
DRIVE 5	DRIVE 11	DRIVE 17	DRIVE 23	DRIVE 29
DRIVE 6	DRIVE 12	DRIVE 18	DRIVE 24	DRIVE 30
AUX DRIVE (DEM 2B, DEM 4A, DEM 2A, DEM 4B, DEM 1B, DEM 3A, DEM 1A, DEM 3B)				
DRIVE 1	DRIVE 7	DRIVE 13	DRIVE 19	DRIVE 25
DRIVE 2	DRIVE 8	DRIVE 14	DRIVE 20	DRIVE 26
DRIVE 3	DRIVE 9	DRIVE 15	DRIVE 21	DRIVE 27
DRIVE 4	DRIVE 10	DRIVE 16	DRIVE 22	DRIVE 28
DRIVE 5	DRIVE 11	DRIVE 17	DRIVE 23	DRIVE 29
DRIVE 6	DRIVE 12	DRIVE 18	DRIVE 24	DRIVE 30

Figure 2–3 2x30 Drive Numbering Table

2.2 Enclosure Installation Procedures

Warning **The StorageScaler 6000 Enclosure with all its component parts installed is too heavy for a single person to easily install into a Rack cabinet.**

Caution *Ensure that you have fitted and checked a suitable anti-static wrist or ankle strap and observe all conventional ESD precautions when handling StorageScaler 6000 modules and components. Avoid contact with Backplane components and module connectors, etc.*

Note StorageScaler 6000 enclosures are supplied and delivered populated with Backplane, Baseplane, Front Panel, DEMs, and with PCMs installed. The Drive Carrier Modules are supplied as a separate package.

The StorageScaler 6000 enclosure is in compliance with EIA-310-D “Cabinets, Racks, Panels, and Associated Equipment”. The enclosure is designed to fit within a 4U rack space. A typical rack mounting installation in shown in Figure 2–4.

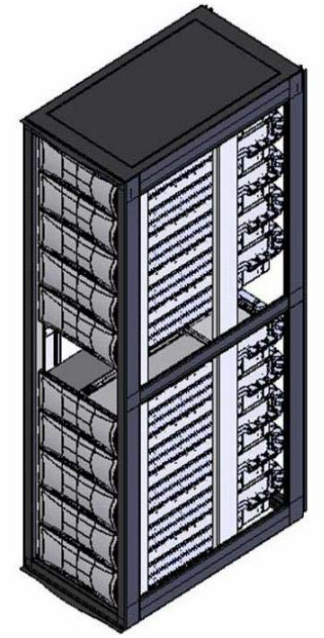


Figure 2–4 Full Rack without 9900 controllers.

2.3 I/O Module Configurations

2.3.1 Controller Options

The StorageScaler 6000 has a standard SAS JBOD IO controller, which employs a 36-port expander with zoning. The zoning is implemented via a preset piano-switch located on the enclosure baseboard. Host ports 1 and 2 present drives 1 through 30 and host ports 3 and 4 present drives 31 through 60. Each host port responds with drive information applicable only to the drives presented on the respective zone and enclosure status information for the entire enclosure.

2.4 DEM

The StorageScaler 6000 enclosure contains eight (8) top-loadable, hot swappable DEMs. The DEMs provide the SAS connectivity between the I/O module and the HDDs located within the enclosure. Each DEM connects to a single port of the HDD based on the location within the enclosure in which it is installed. Each of the eight DEMS installed in the enclosure has a unique I^2C and SAS address based on a DataDirect Network SAS address generation scheme.

2.5 Drive Enclosure Device Addressing

See Appendix A.

2.6 Grounding Checks

The product must only be connected to a power source that has a safety electrical earth connection.

Warning **If more than one product is fitted in a rack, the earth connection to the rack is even more important, because the rack will then have a high “EARTH LEAKAGE CURRENT” (“TOUCH CURRENT”).**

The earth connection to the rack must be checked before switching on, by an electrical engineer who is qualified to the appropriate local and National standards to perform the check.

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Chapter 3

Operation

3.1 Before You Begin

Before powering up the enclosure, please ensure that all the modules are firmly seated in their correct bays.

3.2 Power On / Power Down

Caution *Do not operate the subsystem until the ambient temperature is within the specified operating range. If the drives have been recently installed, ensure they have had time to acclimatize before operating them.*

To Power On the enclosure.

1. Apply AC power to the enclosure.
2. Turn the PCMs to ON.

All LEDs on the I/O Panel should be lit (Green) when the enclosure power is activated (and the disk drive motors should start).

Important **If AC power is lost for any reason, on restoration of power the enclosure will re-start automatically.**

To power the enclosure down, switch off the PCMs installed in the Enclosure.

3.2.1 PCM LEDs

The PCM incorporates 4 LEDs, located above the On/Off switch. Please refer to Figure 1–4 and Figure 1–5.

3.2.2 I/O Panel LEDs

The I/O Panel LEDs fault and status conditions are shown in Figure 3–1.

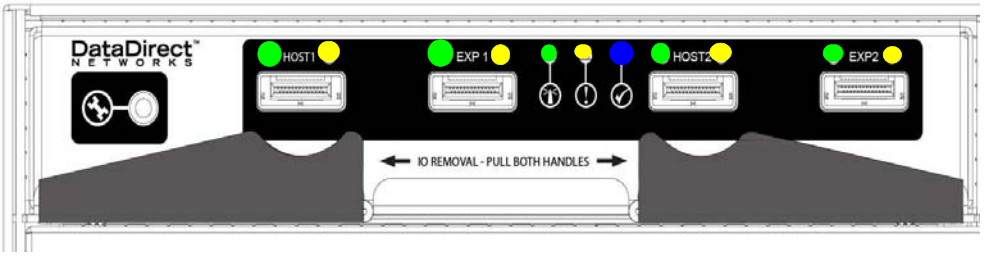


Figure 3–1 I/O Panel LEDs

Table 3–1 defines the LED indicators incorporated on the I/O module.

Table 3–1 I/O Module LEDs

LED		Color	STATUS	Definition
Host Port 1 Expansion Port 1 Host Port 2 Expansion Port 2		**Green**	ON OFF	•Incoming signal is GOOD •No connection or incorrect connection
Host Port 1 Expansion Port 1 Host Port 2 Expansion Port 2		**Amber**	ON OFF	•Fault •No faults
	I/O Module OK	**Green**	ON OFF	•properly booted and functioning correctly internal fault
	I/O Module Fault	**Amber**	OFF ON	•No Faults present I/O Fault
	I/O Module Identify	**Blue**	ON OFF	•Receiving SES Command Not receiving SES Command

Chapter 4

Troubleshooting and Problem Solving

4.1 Overview

The Storage Scaler 6000 Drive Enclosure includes an Enclosure Services Processor and associated monitoring and control logic to enable it to diagnose problems within the enclosure's power, cooling, and drive systems.

The sensors for power and cooling conditions are housed within the PCMs. Each unit is independently monitored.

4.2 Initial Start-up Problems

4.2.1 Faulty Cords

First check that you have wired up the subsystem correctly. If:

- cords are missing or damaged,
- plugs are incorrect,
- cords are too short,

Call your supplier for a replacement.

4.2.2 Alarm Sounds On Power Up

The Audible Alarm sounds anytime the top cover is open. The alarm mutes automatically once the cover is closed.

4.2.3 Green "Signal Good" LED on I/O Module Not Lit

Check to ensure that the cables have not been reversed during installation.

4.2.4 Computer Doesn't Recognize the Storage Scaler 6000 Subsystem

1. Check that the SAS interface cables from the Storage Scaler 6000 enclosure to the host computer, or I/O controller, are fitted correctly.

2. Check that there is a valid SAS signal present at the I/O connector. If there is no signal present, ensure the cable has been properly inserted.

3. Check the I/O module setup as follows:
   - Ensure the I/O module has been correctly installed and all external links and cables are securely fitted.
   - Ensure the maximum cable length has not been exceeded.

4.3 LEDs

Green LEDs are always used for good or positive indication. Amber LEDs indicate there is a critical fault present within the module. See specific LED tables for further information:

- Section 4.3.1, "HDD (Hard Disk Drive)"
- Section 4.3.2, "PCM (Power Cooling Module)"
- Section 4.3.3, "DEM (Drive Expander Module)"
- Section 4.3.4, "I/O Module"
- Section 4.3.5, "Front Panel Drive Activity Indicators"

4.3.1 HDD (Hard Disk Drive)

When a HDD is faulted, Table 4–1 describes the fault LED behavior:

- Under Normal conditions, the LEDs should all be illuminated constant GREEN
- If a problem is detected, the color of the relevant LED will change to AMBER.

Table 4–1 HDD LEDs

Location	Color	Identifier	Behavior
Enclosure front	**Amber**	**Enclosure fault**	**This LED is ON with a drive fault**
Enclosure front	**Amber**	**Drive fault**	**This LED is ON with a drive fault**

4.3.2 PCM (Power Cooling Module)

The PCM LEDs are shown in Table 4–2:

- Under Normal conditions, the LEDs should all be illuminated constant GREEN
- If a problem is detected, the color of the relevant LED will change to AMBER.

Table 4–2 PCM LEDs

Location	Color	LED Identifier	Behavior
FRONT Enclosure	**Amber**	**Enclosure fault**	**This LED is ON with a PCM fault.**
REAR Enclosure PCM	**Amber**	**PCM fault**	**This LED is ON with an AC input, DC output, fan or other PCM fault.**
REAR Enclosure PCM	**Green**	**AC OK**	**This LED is ON with a DC or fan fault. This LED is OFF with an AC input failure.**
REAR Enclosure PCM	**Green**	**DC OK**	**This LED is ON with an AC or fan fault. This LED is OFF with an DC output failure**

4.3.3 DEM (Drive Expander Module)

The DEM fault LEDs are explained in Table 4–3:

- Under Normal conditions, the LEDs should all be illuminated constant GREEN
- If a problem is detected, the color of the relevant LED will change to AMBER.

Table 4–3 DEM LEDs

Location	Color	LED Identifier	Behavior
FRONT Enclosure	**Amber**	**Enclosure fault**	**ON with a DEM fault.**
FRONT Enclosure	**Amber**	**DEM fault**	**ON with a DEM fault.**
Internal (DEM) Enclosure	**Amber**	**DEM fault**	**ON with a DEM fault.**
Internal (DEM) Enclosure	**Green**	**DC OK**	**ON when the DC voltage regulation is within limits. OFF with a DC output failure.**
Internal (DEM) Enclosure	**Green**	**Expander MIPS ready**	**ON when the expander internal processor is booted and operating correctly. OFF when the expander internal processor is NOT booted or ready.**
Internal (DEM) Enclosure	**BLUE**	**DEM identify**	**ON indicates that this DEM is being sent an identify command by the SEP.**

4.3.4 I/O Module

The I/O Module LEDs are explained in Table 4–4.

- Under Normal conditions, the LEDs should all be illuminated constant GREEN
- If a problem is detected, the color of the relevant LED will change to AMBER.

Table 4–4 I/O LEDs

Location	Color	LED Identifier	Behavior
FRONT Enclosure	**Amber**	**Enclosure fault**	**ON with an I/O fault.**
REAR Enclosure	**Green**	**I/O OK**	**OFF when an I/O module detectable fault is present. INDEPENDENT of SAS link fault condition and stays lit during a SAS link fault.**
REAR Enclosure	**Amber**	**I/O fault**	**ON when a detectable fault is present in the I/O module. INDEPENDENT of SAS link fault condition and stays lit during a SAS link fault.**
REAR Enclosure	**Green**	**SAS Link Activity**	**ON when a valid link is present on any of the 4 links of the 4-wide port. OFF when none of the 4 links of the 4-wide port have a valid connection.**
REAR Enclosure	**Amber**	**SAS Link Fault**	**ON when a fault is present on any of the 4 links of the 4-wide port. OFF when none of the 4 links of the 4-wide port have a fault.**

4.3.5 Front Panel Drive Activity Indicators

The Front Panel Drive Activity Indicators show the aggregated status of all the modules. This panel and its associated LEDs are shown in Figure 4–1. The Display Panel LEDs are defined in Table 4–5.

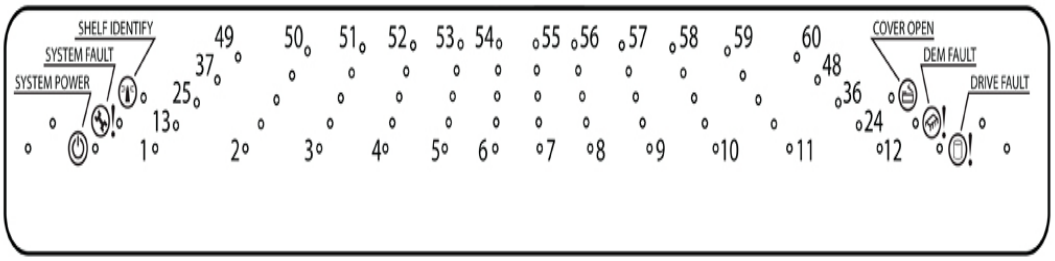


Figure 4–1 Front Panel Drive Activity Indicators Panel

Table 4–5 Display Panel LEDs

ICON	LABEL	COLOR	Definition	Normal Behavior
	Shelf Identify	AMBER	enclosure Identify Currently not implemented.	**ON**-SES is sending an Identify command. **OFF**-SES is NOT sending an Identify command
	System Fault	AMBER	Enclosure Fault	**ON**-one or more components within enclosure have failed. A service action is required. Exact failed component has its own amber fault LED lit. **OFF**-no detectable faults
	System Power	GREEN	Enclosure Powered ON	**ON** - DC power is present **OFF** - DC power is NOT present LED does NOT flash under normal operating conditions.
	Cover Open	AMBER	Enclosure cover is open	**OFF**-both cover pieces securely closed and latched in place. **ON**-either of the cover pieces is NOT securely closed and latched in place
	DEM Fault	AMBER	DEM fault Currently not implemented.	**OFF**-all DEMs operating correctly. **ON**-at least one DEM has failed; service action required
	Drive Fault	AMBER	Drive fault Currently not implemented.	**ON**-one or more HDDs are faulted. SES must determine exact HDD. **OFF**-no detectable drive faults

4.4 Troubleshooting

The following sections describe common problems, with possible solutions, which can occur with your Storage Scaler 6000 system

4.4.1 Thermal Control

The Storage Scaler 6000 Enclosure uses extensive thermal monitoring and takes a number of actions to ensure component temperatures are kept low and also to minimize acoustic noise. Air flow is from the front, over the drive section, through the midplane, through the I/O modules to rear of the enclosure.

Symptom	Cause	Action
If the ambient air is cool (below 25 °C) and the fans are observed to increase in speed, then some restriction on airflow may be causing additional internal temperature rise. **Note:** This is not a fault condition.	The first stage in the thermal control process is for the fans to automatically increase in speed when a thermal threshold is reached. This may be caused by higher ambient temperatures in the local environment and may be perfectly normal. **Note:** This threshold changes according to the number of drives and PCMs fitted.	**1** Check the installation for any airflow restrictions at either the front or rear of the enclosure. A minimum gap of 25mm at the front and 50mm at the rear is recommended. **2** Check for restrictions due to dust build-up; clean as appropriate. **3** Check for excessive re-circulation of heated air from rear to the front. Use in a fully enclosed rack installation is not recommended. **4** Check that all Blank modules are in place. **5** Reduce the ambient temperature.

4.4.2 Thermal Alarm

Symptom	Cause	Action
• Display Panel PCM/ Cooling Fault LED. • An AMBER LED on one or more PCMs. • Air temperature exiting PCM above 35°C.	If the internal temperature measured in the airflow through the enclosure exceeds a pre-set threshold, a thermal alarm will sound.	**1** Check local ambient environment temperature is below the upper 40°C specification. **2** Check the installation for any airflow restrictions at either the front or rear of the enclosure. A minimum gap of 25mm at the front and 50mm at the rear is recommended. **3** Check for restrictions due to dust build-up. Clean as appropriate. **4** Check for excessive re-circulation of heated air from rear to the front. Use in a fully enclosed rack installation is not recommended. **5** If possible, shutdown the enclosure and investigate the problem before continuing.

4.4.3 Thermal Shutdown

Important **An Enclosure will shut down when a critical temperature threshold is exceeded in order to prevent permanent damage to the disk drives.**

4.5 Dealing with Hardware Faults

Ensure that you have obtained a replacement module of the same type *before* removing any faulty module.

Warning **If the Storage Scaler 6000 subsystem is powered up and you remove any module, replace it immediately. If the subsystem is used with modules or module blanks missing for more than a few minutes, the Enclosure can overheat, causing power failure and data loss. Such use will invalidate the warranty.**

- Replace a faulty drive with a drive of the same type and equal or greater capacity.
- All the supplied plug-in PCMs, electronics modules, and blank modules must be in place for the air to flow correctly around the cabinet.

4.6 Replacing a Module

Warning **Whenever replacing a module NEVER leave an EMPTY bay in the rear of the enclosure, obtain a replacement before removing the problem part.**

Please refer to Chapter 2 , "Getting Started" for information on the initial installation of the plug-in modules in the Storage Scaler 6000 enclosure.

Warning **Observe all conventional ESD precautions when handling Storage Scaler 6000 modules and components. Avoid contact with Backplane components and module connectors, etc.**

4.6.1 Power Cooling Modules

Warning **Do not remove covers from the Power Cooling module (PCM). There is a danger of electric shock. Return the PCM to your supplier for repair.**

Warning **To ensure your system has warning of a power failure please disconnect the power from the power supply, by either the switch (where present) or by physically removing the power source, prior to removing the PCM from the enclosure/shelf. Do not remove the faulty PCM unless you have a replacement unit of the correct type ready for insertion. The system must not be run without all units in place.**

If a power supply unit or its fan is faulty, you must replace the whole PCM. You must not take any longer than 5 minutes to replace this unit to prevent the enclosure from over-heating.

To remove an AC PCM/Cooling Module- Handle Model:

If a power supply unit or its fan is faulty, you must replace the whole PCM/Cooling module.

As there should always be two PCMs installed, you can continue working while replacing the faulty module.

1. Make sure you identify the faulty PCM correctly from the two modules installed.
2. Lift latch which secures the power supply cord.
3. Switch off and disconnect the power supply cord.

4 Lift the PCM handle to the open position to cam the PCM out of the enclosure.

5 Grip the handle and withdraw the PCM.

To remove an AC PCM - Thumb Screw Model:

Warning **Do not remove the faulty PCM unless you have a replacement unit of the correct type ready for insertion.**

If a power supply unit or its fan is faulty, you must replace the whole PCM. As there should always be two PCMs installed, you can continue working while replacing the faulty module.

1 Make sure you identify the faulty PCM correctly from the two modules installed.

2 Lift latch which secures the power supply cord.

3 Switch off and disconnect the power supply cord.

4 Remove the two thumbscrews on the right and left sides of the unit.

5 Firmly grip the handle on the bottom of the unit and withdraw the PCM.

To install an AC PCM - Handle Model:

6 Check for damage, especially to the rear connector on the PCM.

Caution *Handle the module carefully and avoid damaging the connector pins. Do not install the module if any pins appear to be bent.*

7 With the PCM handle in the open position, slide the module into the enclosure.

8 Cam the module home by manually closing the PCM handle. A click should be heard as the handle latches engage.

9 Connect the power supply cord to the power source, secure the latch over the cord, and switch the power supply ON.

Note The alarm will sound until the new PCM is operating correctly.

To install an AC PCM - Thumbscrew Model:

1 Check for damage, especially to the rear connector on the PCM.

Caution *Handle the module carefully and avoid damaging the connector pins. Do not install the module if any pins appear to be bent.*

2 Slide the module into the enclosure and push unit you hear a click as the latch is engaged.

3 Secure the two thumbscrews on the left and right sides of the unit.

4 Connect the power supply cord to the power source; secure latch, and switch the power supply ON.

Note The alarm will sound until the new PCM is operating correctly.

4.6.2 I/O Module

Warning **Do not remove this module unless a replacement can be immediately added. The system must not be run without all units in place.**

To remove the I/O Module:

1. Release the two latches on the bottom of the unit by simply pulling each latch out and away from unit.
2. Pull the latches forward to cam the module out of the enclosure.
3. Grip the unit securely and withdraw the module.

To installing the I/O Module:

4. With the latches in the open position, slide the EBOD module into the enclosure until the latch engages automatically.
5. Cam the module home by manually closing the latches. A click should be heard as the latch engages.

4.6.3 Replacing the Drive Carrier Module

Warning **Observe all conventional ESD precautions when handling Storage Scaler 6000 modules and components. Avoid contact with backplane components and module connectors, etc.**

Instructions are also clearly labeled on the inside cover of the enclosures.

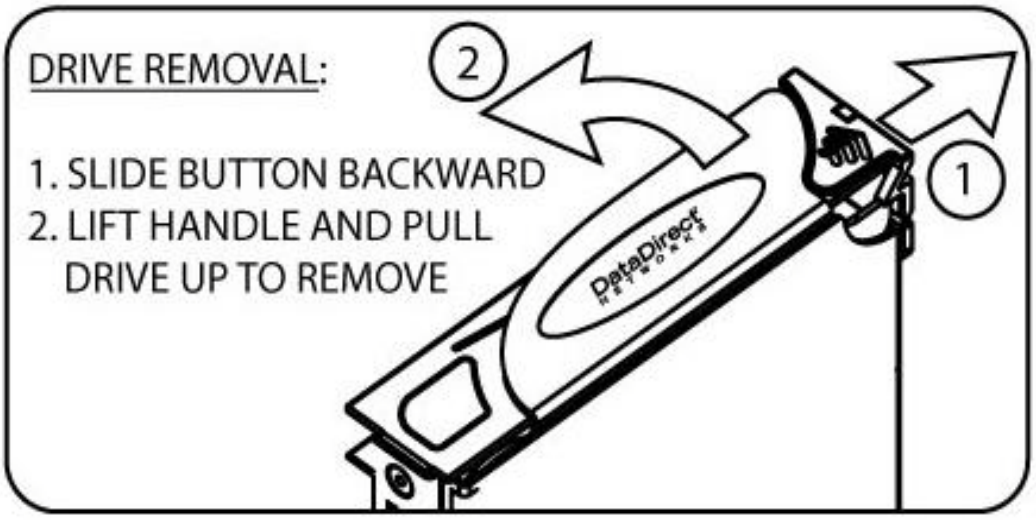


Figure 4–2 Drive Carrier - Handle Released

Caution ***Drive spin down***
*Damage can occur to a drive if it is removed while still spinning. If possible, use the operating system to spindown the drives prior to removal. If this is not possible, we recommend that you perform **All** steps of the following procedure to ensure that the drive has stopped prior to removal:*

To Insert the Drive Carrier Module

1 Release the carrier handle by sliding the latch backwards.

2 Insert the carrier into the enclosure.

3 Slide the drive carrier, gently, all the way into the enclosure.

4 Cam the drive carrier home. The camming foot on the base of the carrier will engage into a slot in the enclosure.

5 When the carrier is fully home, close the handle. You should hear a click as the latch engages and holds the handle closed.

6 Close the enclosure.

4.7Replacing the DEM

Important **The DEM card should only be replaced by trained personnel. The handle rib will light up BLUE for service.**

Warning **Observe all conventional ESD precautions when handling Storage Scaler 6000 modules and components. Avoid contact with backplane components and module connectors, etc.**

Instructions are also clearly labeled on the inside cover of the enclosures (Figure 4–3).

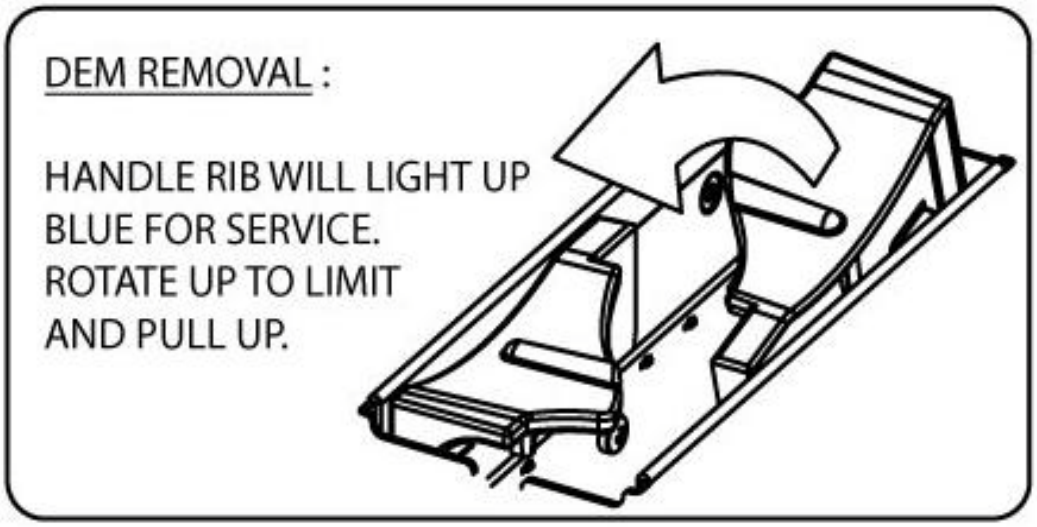


Figure 4–3 DEM Removal Label

To Replace the DEM

1. Grip the top latch, rotate it until you reach the limit of rotation, and then pull up to remove the DEM.
2. Insert the replacement DEM.
3. Press on the latch to rotate it down to lock it into place.

A

Drive Enclosure Addressing

A.1 Background

This sections explains the drive enclosure addressing of the disk enclosures for the StorageScaler 6000 Drive Enclosure. There are three drive numbering options:

- 1 x 60 (one set of drives 1 through 60); (Figure A–1, use Figure A–4, and Figure A–5 for cabling).
- 2 x 30 (two sets of drives 1 through 30); (Figure A–2, use Figure A–6 for cabling).
- 4 x 15 (four sets of drives 1 through 15); (Figure A–3, use Figure A–7 for cabling).

Figure A–1 1 x 60 Drive Layout Configuration

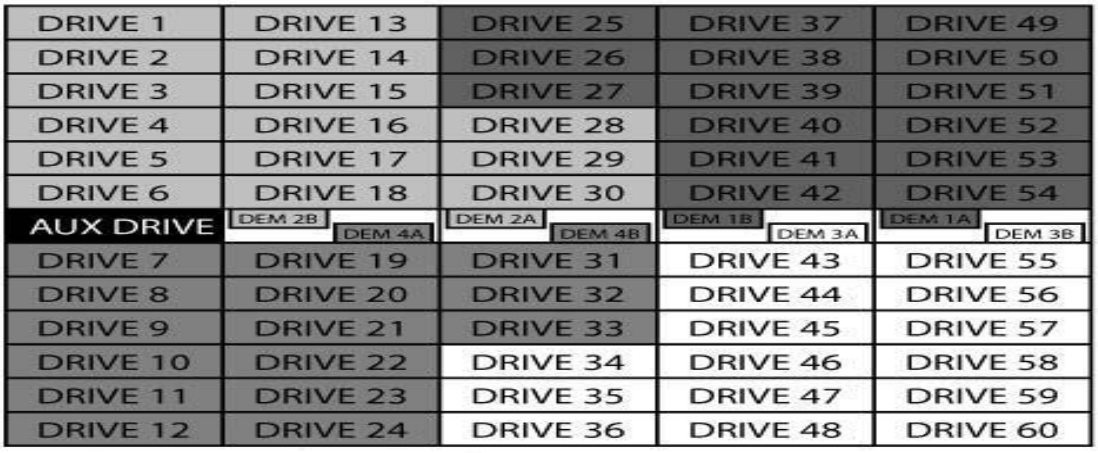


Figure A–2 2 x 30 Drive Layout Configuration

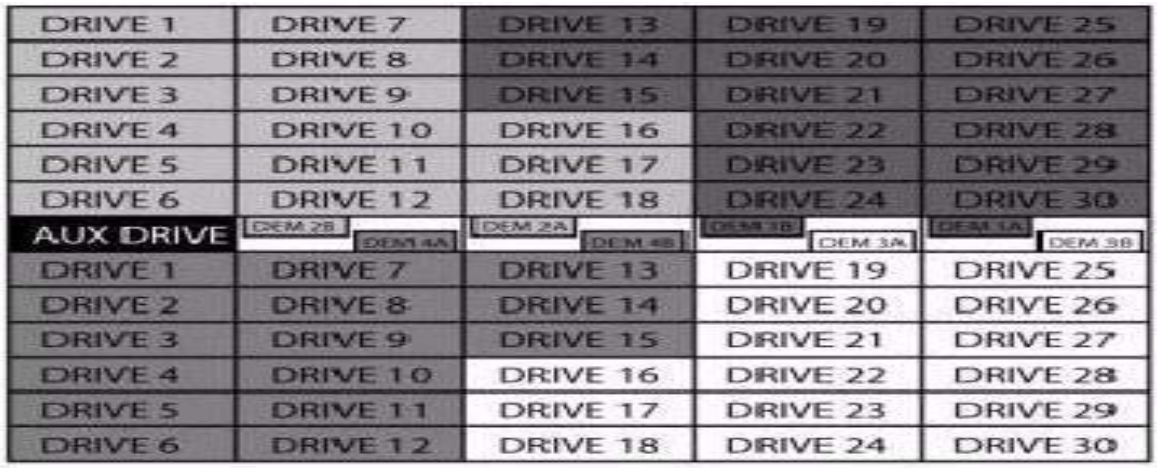


Figure A–3 4 x 15 Drive Layout Configuration

DRIVE 1	DRIVE 7	DRIVE 1	DRIVE 4	DRIVE 10
DRIVE 2	DRIVE 8	DRIVE 2	DRIVE 5	DRIVE 11
DRIVE 3	DRIVE 9	DRIVE 3	DRIVE 6	DRIVE 12
DRIVE 4	DRIVE 10	DRIVE 13	DRIVE 7	DRIVE 13
DRIVE 5	DRIVE 11	DRIVE 14	DRIVE 8	DRIVE 14
DRIVE 6	DRIVE 12	DRIVE 15	DRIVE 9	DRIVE 15
	DEM 2B	DEM 2A	DEM 1B	DEM 1A
	DEM 4A	DEM 4B	DEM 3A	DEM 3B
DRIVE 1	DRIVE 7	DRIVE 13	DRIVE 4	DRIVE 10
DRIVE 2	DRIVE 8	DRIVE 14	DRIVE 5	DRIVE 11
DRIVE 3	DRIVE 9	DRIVE 15	DRIVE 6	DRIVE 12
DRIVE 4	DRIVE 10	DRIVE 1	DRIVE 7	DRIVE 13
DRIVE 5	DRIVE 11	DRIVE 2	DRIVE 8	DRIVE 14
DRIVE 6	DRIVE 12	DRIVE 3	DRIVE 9	DRIVE 15

Figure A–4 StorageScaler 6000 - 1x60 Configuration

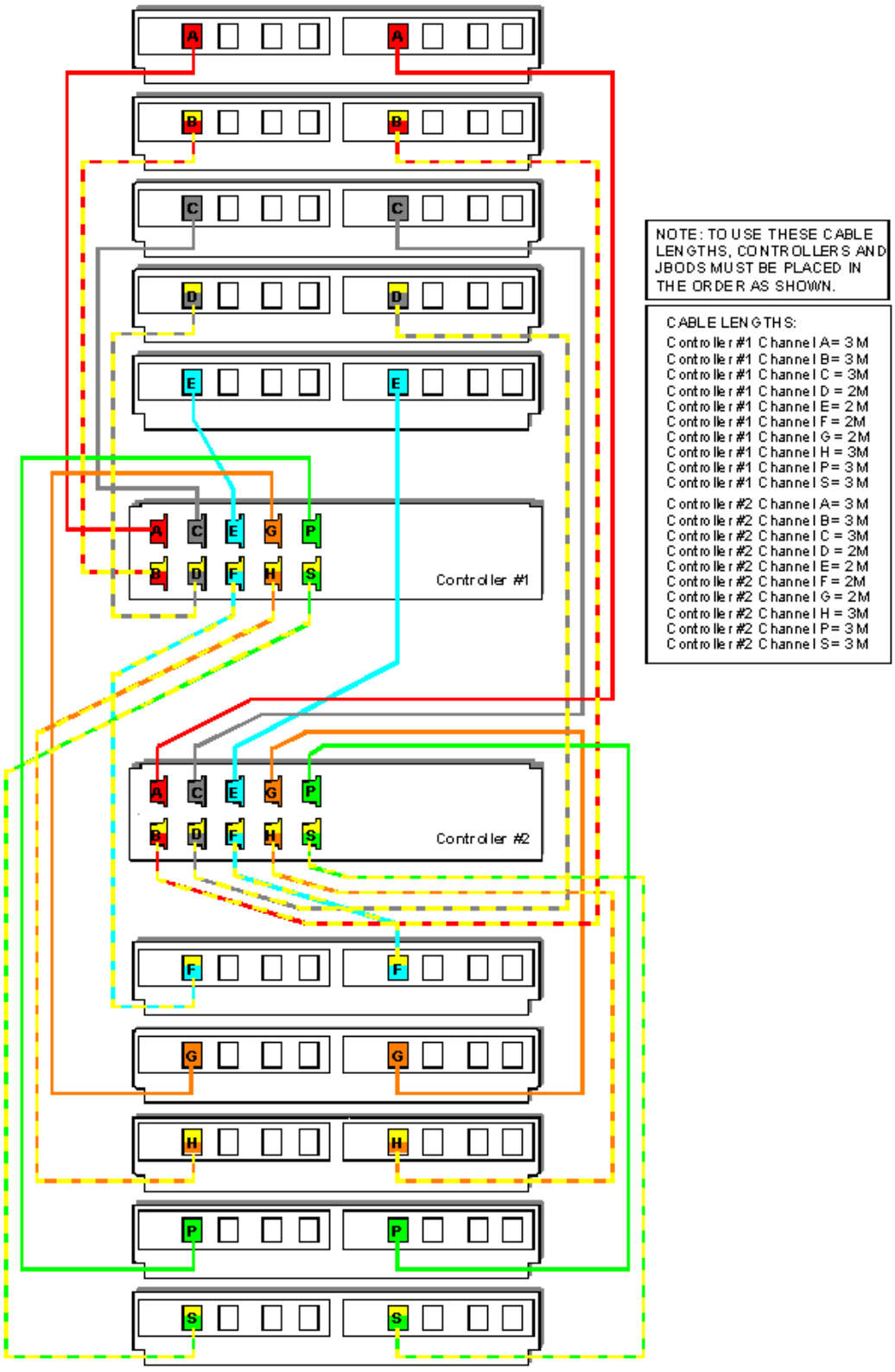

NOTE: TO USE THESE CABLE LENGTHS, CONTROLLERS AND JBODS MUST BE PLACED IN THE ORDER AS SHOWN.
CABLE LENGTHS:
Controller #1 Channel A= 3 M
Controller #1 Channel B= 3 M
Controller #1 Channel C = 3M
Controller #1 Channel D = 2M
Controller #1 Channel E= 2 M
Controller #1 Channel F = 2M
Controller #1 Channel G = 2M
Controller #1 Channel H = 3M
Controller #1 Channel P= 3 M
Controller #1 Channel S= 3 M
Controller #2 Channel A= 3 M
Controller #2 Channel B= 3 M
Controller #2 Channel C = 3M
Controller #2 Channel D = 2M
Controller #2 Channel E= 2 M
Controller #2 Channel F = 2M
Controller #2 Channel G = 2M
Controller #2 Channel H = 3M
Controller #2 Channel P= 3 M
Controller #2 Channel S= 3 M
Controller #1
Controller #2

Figure A–5 StorageScaler 6000 - Daisy Chain Configuration for 2 Rack 20 Drawer

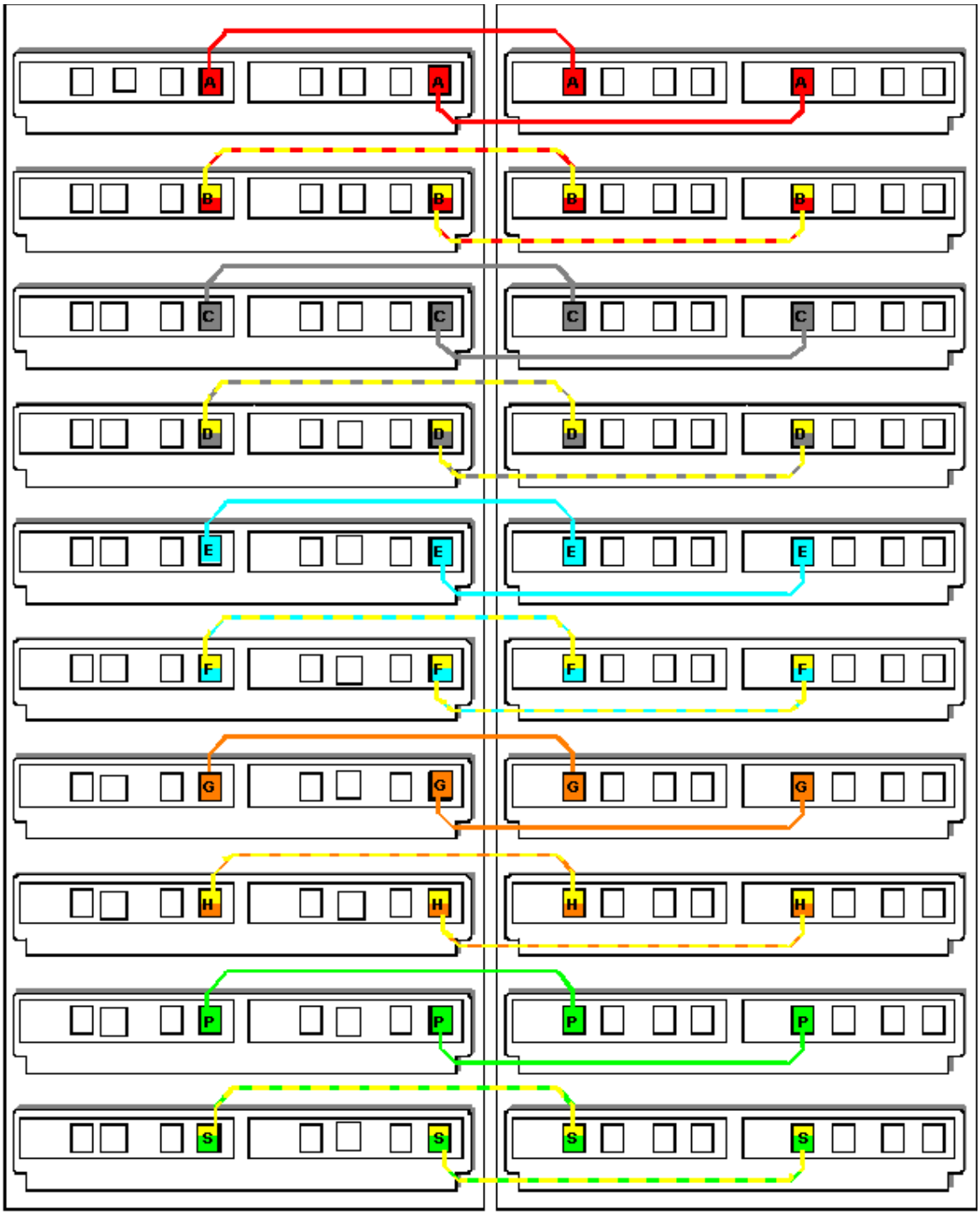


Figure A–6 StorageScaler 6000 - 2x30 Configuration

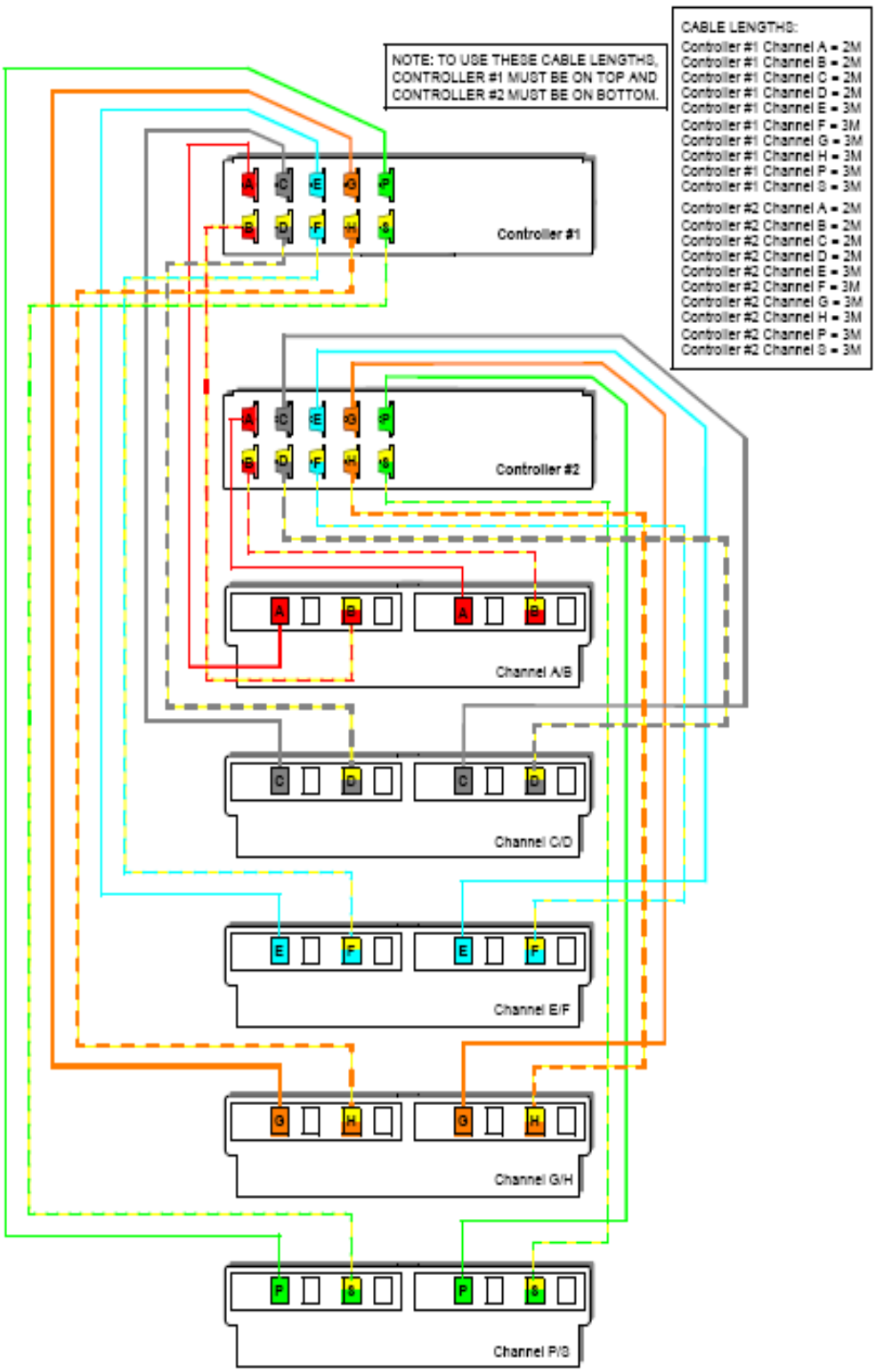
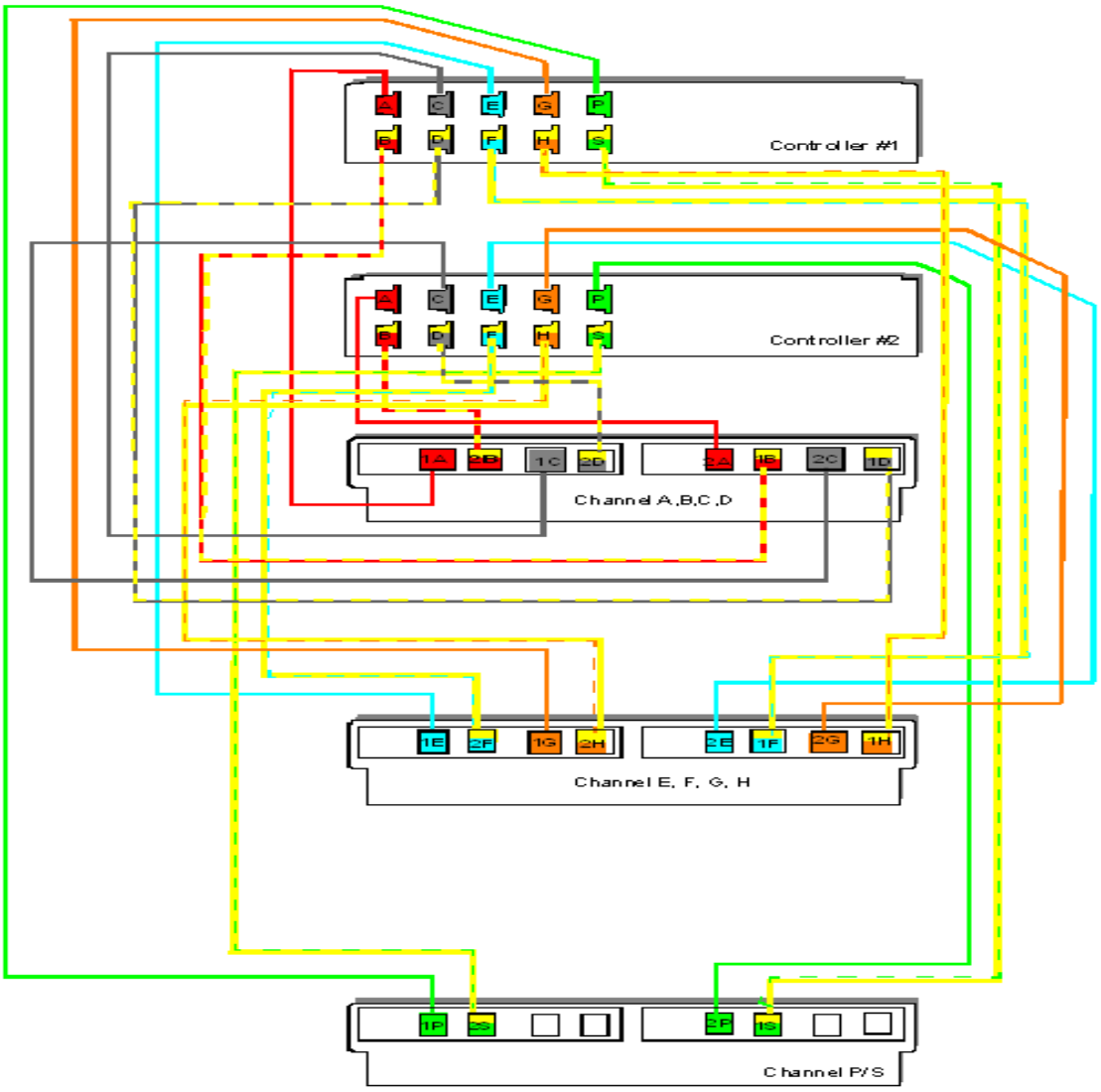

NOTE: TO USE THESE CABLE LENGTHS, CONTROLLER #1 MUST BE ON TOP AND CONTROLLER #2 MUST BE ON BOTTOM.
CABLE LENGTHS:
Controller #1 Channel A = 2M
Controller #1 Channel B = 2M
Controller #1 Channel C = 2M
Controller #1 Channel D = 2M
Controller #1 Channel E = 3M
Controller #1 Channel F = 3M
Controller #1 Channel G = 3M
Controller #1 Channel H = 3M
Controller #1 Channel P = 3M
Controller #1 Channel S = 3M
Controller #2 Channel A = 2M
Controller #2 Channel B = 2M
Controller #2 Channel C = 2M
Controller #2 Channel D = 2M
Controller #2 Channel E = 3M
Controller #2 Channel F = 3M
Controller #2 Channel G = 3M
Controller #2 Channel H = 3M
Controller #2 Channel P = 3M
Controller #2 Channel S = 3M
Controller #1
Controller #2
Channel A/B
Channel C/D
Channel E/F
Channel G/H
Channel P/S

Figure A–7 StorageScaler 6000 - 4 x 15 Configuration

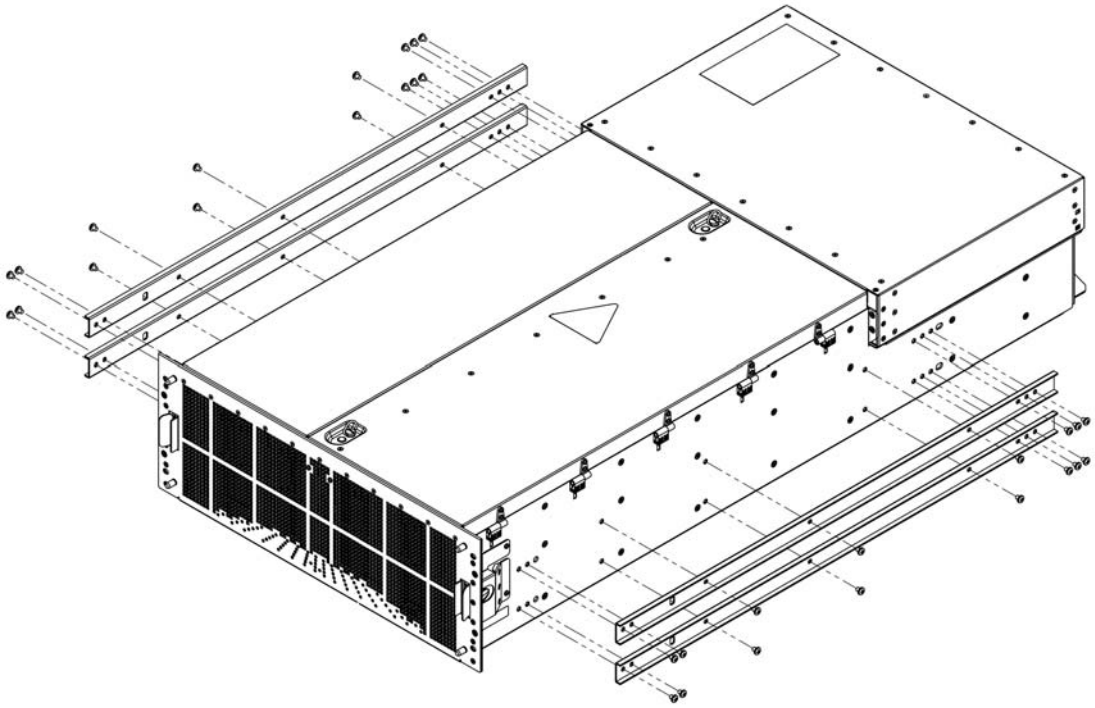


Appendix B. Rack-Mounting the StorageScaler 6000

The Storage Scaler 6000 is designed to fit within a 4U rack space. Follow these steps to mount the system in your rack:

1. Using eight (8) 32×0.188" Phillips panhead screws for each slider, attach the four (4) inner sliders to the chassis as shown in Figure B- 1 below.

Figure B-1. Attach 4 Inner Sliders to Chassis

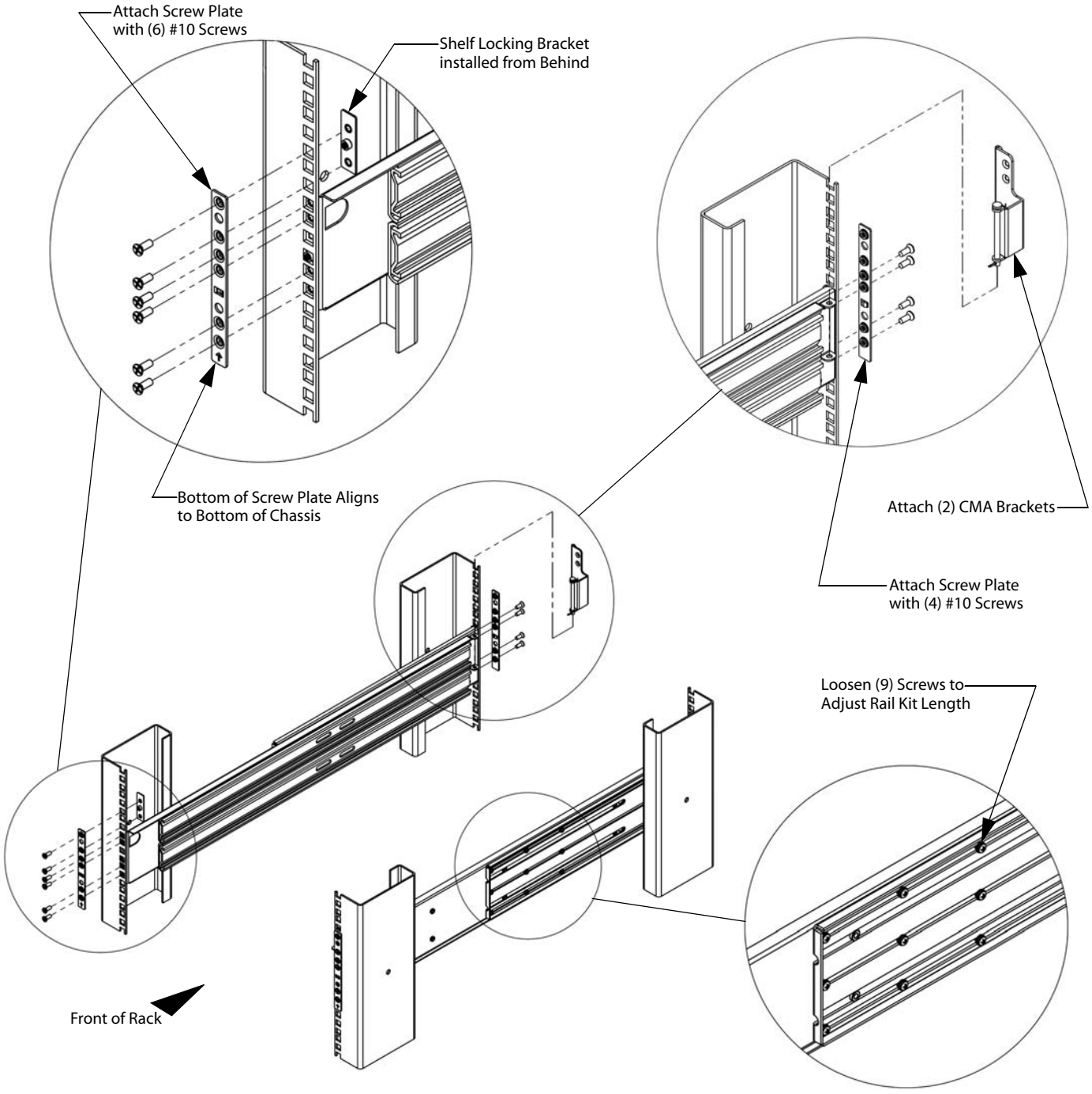


2. Loosen the nine (9) screws on the rail kit and set the length to fit the depth of your rack Figure B-2. Tighten all the screws once the rail kit is set to the desired length. Repeat for the other rail kit.

3. Attach the two (2) rail kits to your rack as shown in Figure B-2. Make sure you leave enough space for the unit—bottom of screw plate aligns to bottom of Storage Scaler 6000 chassis.
At the front, use one (1) screw plate, one (1) shelf locking bracket (installed from behind), and six (6) #10 screws.
For the rear end, use one (1) screw plate and four (4) #10 screws.

4. If the depth of your rack is more than 25.5inches (647mm), attach the two (2) Cable Management Arm (CMA) brackets to the rear end of the rail kits Figure B-2.

Figure B-2. Attach Rail Kits to Rack



5. Using two (2) 10-32×0.50" (100d) Phillips flathead screws for each CMA, attach the CMA to the CMA brackets Figure B-3. If the depth of your rack is 25.5inches (647mm) or less, attach the CMA directly to the rack, above the rail kits. For square-hole rack, add 100d #10 shoulder washers.

6. With the help of a partner, hold the chassis close to the rail kits. Align the rear flanges on chassis with the rail kit flanges Figure B-3 and slide the chassis into rack until the sliders are engaged (slide in about 12 inches until stopped). Then slide the chassis out until locked. Depress the slider locks and proceed to slide the chassis all the way in.

7. Using two (2) 8-32×0.25" Phillips panhead screws, secure the two CMA to rear of chassis.

Figure B-3. Install Chassis to Rack